

PATENT COOPERATION TREATY

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From the
INTERNATIONAL SEARCHING AUTHORITY

PCT

WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY

(PCT Rule 43bis.1)

To:

Valea AB
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Sverige

4/8

Date of mailing
(day/month/year)

01-07-2005

Applicant's or agent's file reference

P17031PC00

FOR FURTHER ACTION

See paragraph 2 below

International application No.

PCT/SE2005/000098

International filing date (day/month/year)

26-01-2005

Priority date (day/month/year)

26-01-2004

International Patent Classification (IPC) or both national classification and IPC

H01J37/26, B81B3/00, G01L1/00, G01L1/14

Applicant

Nanofactory Instruments AB et al

1. This opinion contains indications relating to the following items:

- ☒ Box No. I Basis of the opinion
- ☐ Box No. II Priority
- ☐ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- ☒ Box No. IV Lack of unity of invention
- ☒ Box No. V Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- ☐ Box No. VI Certain documents cited
- ☐ Box No. VII Certain defects in the international application
- ☐ Box No. VIII Certain observations on the international application

2. **FURTHER ACTION**

If a demand for international preliminary examination is made, this opinion will be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA") except that this does not apply where the applicant chooses an Authority other than this one to be IPEA and the chosen IPEA has notified the International Bureau under Rule 66.1bis(b) that written opinions of this International Searching Authority will not be so considered.

If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of 3 months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later.

For further opinions, see Form PCT/ISA/220.

3. For further details, see notes to Form PCT/ISA/220.

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**WRITTEN OPINION OF THE
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Box No. I Basis of this opinion

1. With regard to the language, this opinion has been established on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.

☐ This opinion has been established on the basis of a translation from the original language into the following language, _____, which is the language of a translation furnished for the purposes of international search (under Rules 12.3 and 23.1(b)).

2. With regard to any nucleotide and/or amino acid sequence disclosed in the international application and necessary to the claimed invention, this opinion has been established on the basis of:

a. type of material

☐ a sequence listing

☐ table(s) related to the sequence listing

b. format of material

☐ in written format

☐ in computer readable form

c. time of filing/furnishing

☐ contained in the international application as filed.

☐ filed together with the international application in computer readable form.

☐ furnished subsequently to this Authority for the purposes of search.

3. ☐ In addition, in the case that more than one version or copy of a sequence listing and/or table relating thereto has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that in the application as filed or does not go beyond the application as filed, as appropriate, were furnished.

4. Additional comments:

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Box No. IV Lack of unity of invention

1. ☒ In response to the invitation (Form PCT/IPEA/206) to pay additional fees the applicant has:
- ☐ paid additional fees
- ☐ paid additional fees under protest
- ☒ Not paid additional fees
2. ☐ This Authority found that the requirement of unity of invention is not complied with and chose not to invite the applicant to pay additional fees.
3. This Authority considers that the requirement of unity of invention in accordance with Rule 13.1, 13.2 and 13.3 is
- ☐ Complied with
- ☒ Not Complied with for the following reasons:

The following separate inventions were identified:

I: Claims 1-11 relate to the problem of how to measure forces. This problem appears to be solved by attaching a membrane to a bulk structure through springs. The movements of the membrane, with respect to the bulk structure, are then measured using detection elements.

II: Claims 12-13 relate to the problem of how to produce small force sensors. This problem is solved by, among other things, etching a substrate with a buried oxide layer and doping one side of the substrate. It is not evident from claims 12-13 that the method concerns the production of the force sensor according to claim 1.

III: Claims 14-15 relate to the problem of how to design a nanoindentation sample for use in a nanoindentation system. The sample comprises a base plate and a ridge.

4. Consequently, this opinion has been established in respect of the following parts of the international application:
- ☐ all parts
- ☒ the parts relating to claims Nos. 1-11

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Box No. V Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Claims	<u>2, 4, 6-11</u>	YES
	Claims	<u>1, 3, 5</u>	NO
Inventive step (IS)	Claims	_____	YES
	Claims	<u>1-11</u>	NO
Industrial applicability (IA)	Claims	<u>1-11</u>	YES
	Claims	_____	NO

2. Citations and explanations:

The claimed invention relates to a force sensor and a nanoindentation system that includes said force sensor. The force sensor comprises a membrane that is movable in relation to a bulk structure. The membrane is attached to said bulk structure through springs. The movement of the membrane, in relation to the bulk structure, is measured. The object of the invention is to provide a nanoindentation device that is small and versatile enough to be implemented in an electron microscope device.

Documents cited in the International Search Report:

D1: WO 9612930 A1	D3: WO 03043051 A1
D2: US 5840597 A	D4: WO 0163204 A1

Document D1 discloses an apparatus for microindentation hardness testing and surface imaging. The apparatus comprises a capacitive force sensor (fig.1) with sensor elements that could be fabricated using circuit etching technology (page 13, lines 10-18). The sensor comprises a substrate layer (16 in fig.1) and the substrate layer includes a central plate (20). The substrate layer and the central plate correspond to the bulk structure and the membrane in the claimed invention.

The central plate is attached to the substrate layer through a spring supporting structure, resulting in movement capabilities for the central plate with respect to the

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Supplemental Box

In case the space in any of the preceding boxes is not sufficient.
Continuation of: BOX V

substrate layer (page 16, lines 19-35). The movement of the central plate is measured using detection elements (page 18, lines 19-36). Further, the central plate is attached to a sample holding structure (24), corresponding to the probe holding structure in the claimed invention (page 17, line 16 - page 18, line 10).

Document D2 discloses a semiconductor device with a force sensor. The force sensor comprises a spring-mass system (14 and 15 in fig. 1 and fig.5) responsive to the quantity to be measured and with which a plurality of transducers are associated in order to produce measuring data signals (column 3, line 56-column 4, line 29).

Document D3 discloses a nanoindentation system for use in a transmission electron microscope. The system comprises a nanoindentation probe (5 in fig.4), mounted on a force sensor (page 10, lines 13-32). In one embodiment, the force sensor consists of a flexible membrane. The indentation tip is arranged on one side of the membrane and on the opposite side, a layer of conductive material is arranged. A second electrode is formed at a small distance from the flexible membrane, i.e. a capacitive element is formed. Also, the system comprises a sample holder (3 in fig.1) with a micropositioning device (page 6, lines 24-36). The nanoindentation probe and the sample holder are movable in relation to each other.

Document D4 also discloses a transmission electron microscope that comprises an atomic force microscopy device (abstract and the figures).

The invention according to claim 1 is known from document D1. Therefore, the invention according to claim 1 lacks novelty.

Further, also note that the invention according to claim 1 is considered to lack an inventive step in the light of document D2.

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The invention according to claims 3 and 5 is also known from document D1. Consequently, the invention according to claims 3 and 5 lacks an inventive step.

Document D3 (or document D4) is considered to represent the closest prior art to the invention according to claim 10. The difference between the system according to claim 10 and D3 concerns the design of the force sensor. The movable membrane, according to claim 10, is attached to a bulk structure through at least one spring.

A person skilled in the art, searching for alternative force sensors that could be included in a microscope, knows from document D1 that a movable membrane could be attached to a substrate layer through a spring supporting structure.

Thus, a person skilled in the art, having the system known from D3 as a starting point and searching for alternative solutions, would with the knowledge of D1 attach the membrane to springs. Thus, the skilled person arrives at the invention according to claim 10.

Since D1 and D3 both relate to the same technical field, and no unexpected effect is obtained, the combination of what is known from D1 and D3 is considered obvious for the skilled person.

The invention according to claim 10 is thus not considered to involve an inventive step.

The subject-matter of the remaining claims 2, 4, 6-9 and 11, e.g. the arrangement of the springs, the shape of the springs and the construction of the displacement device, is only considered to constitute details that are obvious for a person skilled in the art.

Therefore, the invention according to claims 2, 4, 6-9 and 11 fails to involve an inventive step.

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The invention according to claims 1-11 is considered to be
industrially applicable.